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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/517,314	03/02/2000	Chih-Chen Cho	M4065.0223/P223	5039

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WASHINGTON, DC 20037-1526

EXAMINER
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KANG, DONGHEE

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 03/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/517,314

Applicant(s)

CHO, CHIH-CHEN

Examiner

Donghee Kang

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 31 December 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1,3-11,13-18,25 and 27-39 is/are pending in the application.
- 4a) Of the above claim(s) 33-38 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3-11,13-18,25,27-32 and 39 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Acknowledgment*

1. Applicant's Response to paper No.23 has been entered and made of Record.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims **1,3-4 & 9-10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Fig.11 of Chiang et al. (US 5,739,579) in view of Fig.9 of Chiang et al. (US 5,739,579).

Chiang teaches a semiconductor structure comprising (Fig.11):

an insulator layer (22); a conductive plug (100) positioned within said insulator layer and formed of a single conductive material; doped region (21) connected to said conductive plug (100); an etch-stop layer (23) located on said insulator layer and surrounding said plug, wherein said etch-stop layer comprises silicon nitride or silicon carbide; a non-conductive layer (101) having an etched via at least partially over said conductive plug, wherein said etches via is wider in diameter than said conductive plug; and a conductive connector (102) formed in said via in electrical contact with said plug. Chiang does not teach in Fig.11 the conductive connector including a first conductor layer and a second conductor layer.

However, Chiang teaches in alternate embodiment Fig.9 the conductive connector including a TiN first (60) and Cu second (61) conductor layers (Col.8, lines 55-67, Col.11, lines 12-48 & Col.14, line 65-Col.15, line 3). It is conventional to use copper (Cu) with a barrier layer as a conductive interconnection layer instead of aluminum (Al) because copper has a lower resistivity than aluminum hence providing a higher speed. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the aluminum with copper/barrier layer since the copper layer provides higher speed than aluminum hence to obtain higher density in ICs.

4. Claims **5-6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. in view of Wang (US 6,184,128).

Regarding claim **5**, Chiang et al. teach the entire claimed invention, as applied to claim 1 explained above, except for non-conductive layer (etch-stop layer) comprising a silicon dioxide. Wang teaches in Fig.7 the silicon dioxide layer acts as an etch-stop layer (Col.5, lines 49-64).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Chiang with a silicon dioxide as taught by Wang in order to provide the etch-stop layer in Chiang's device. Furthermore, one of ordinary skill in the art would have recognized that the silicon nitride and silicon dioxide are both considered to be an art recognized functional equivalent for serving as an etch-stop layer for BPSG dielectric layer.

Regarding claim **6**, Chiang et al. do not teach the non-conductive layer (etch-stop layer) comprising silicon nitride and silicon carbide. However, Wang teaches in Fig.7 the etch-stop layer including the silicon nitride and silicon carbide layer (Col.5, lines 49-64). It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Chiang with a silicon nitride and silicon carbide as taught by Wang in order to provide the etch-stop layer in Chiang's device.

Moreover, it would have been obvious to one of ordinary skill in the art to form the etch-stop layer using silicon nitride and silicon carbide stack layer as taught by Wang, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as matter of obvious design choice. In re Leshin, 125 USPQ 416.

5. Claims **7-8** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. (US 5,739,579) and further in view of Hong et al. (US 6,008,117).

Chiang et al. do not teach the non-conductive layer further comprising borophosphosilicate glass (BPSG) layer. However, Hong et al. teach in Fig.1H the non-conductive layer comprising BPSG (Col.3, lines 16-19). It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the Silicon dioxide of Chiang with a BPSG material as taught by Hong in order to provide a dielectric layer which has a less etch rate than etch-stop layer.

6. Claims **11, 15-17, 25, 27, 30-32 & 39** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. (US 5,739,579) and further in view of Matsuura et al. (US 5,598,027).

Regarding claims **11, 25, 27 & 32**, Chiang et al. teach a semiconductor comprising (Fig.11):

An active region in a substrate (21); a conductive plug (100) formed of a single conductive material positioned within an insulator layer (22) and provided over said active region, said conductive plug being electrically connected with said active region; an etch-stop layer (23) deposited on said insulator layer and around said conductive plug; an intermediate non-conductive layer (101) provided over said etch-stop layer and having an etched via over said plug, wherein the etched via is being wider in diameter than said conductive plug; and a conductive layer disposed in and in contact with said conductive plug. Chiang et al. do not teach the conductive layer including a first and second conductor layer disposed in and in contact with said conductive plug. However, Chiang teaches in alternate embodiment Fig.9 the conductive connector including a TiN first (60) and Cu second (61) conductor layers (Col.8, lines 55-67, Col.11, lines 12-48 & Col.14, line 65-Col.15, line 3). It is conventional to use copper (Cu) with a barrier layer as a conductive interconnection layer instead of aluminum (Al) because copper has a lower resistivity than aluminum hence providing a higher speed. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the aluminum with copper/barrier layer since the copper layer provides higher speed than aluminum hence to obtain higher density in ICs.

Chiang et al. do not teach the intermediate non-conductive layer having a first and a second etched via over said plug, wherein said second etched via is above and has a greater diameter than said first etched via. Matsuura in Fig. 1 teaches forming a double (first and second) etched via (7) formed over a conductive plug (4), wherein said second etched via has a greater than said first etched via. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Matsuura into the Chiang's device double etched via can be reduced a height of the ICs so as to form several interconnection layer without increasing a volume.

Neither Chiang nor Matsuura teaches a processing unit which is coupled to a semiconductor device. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have a processor unit in processor-based device, since the processor is required in the processor-based device to operate a device.

Regarding claims 15-16 & 30-31, Chiang as modified by Matsuura teaches the first conductive layer and the second conductive layer comprising titanium nitride and copper, respectively.

Regarding claims **17 & 39**, Chiang as modified Matsuura does not expressly teach a plurality of memory cells. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a plurality of memory cells, since it has been held that mere of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8.



7. Claims **13-14 & 28-29** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. in view of Maturra, as applied to claim 11 above, and further in view of Hong (US 6,008,117).

Chiang et al. do not teach non-conductive layer comprising BPSG material. However, Hong et al. teach the non-conductive layer disposed on the etch-stop comprising BPSG (Col.3, lines 6-19). It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the Silicon dioxide of Chiang with a BPSG material as taught by Hong in order to provide a dielectric layer which has a less etch rate than etch-stop layer.

### ***Response to Arguments***

8. Applicant's arguments filed 31 December 2002 have been fully considered but they are not persuasive.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). It is conventional to use copper (Cu) layer as a conductive interconnection layer instead of aluminum (Al) because copper has a lower resistivity than aluminum hence providing a higher speed. Therefore, it would have been obvious to one of ordinary skill

in the art at the time the invention was made to substitute the aluminum with copper layer since the copper layer provides higher speed than aluminum hence to obtain higher density in ICs.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, forming a double (first and second) etched via (7) is generally known in the art. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Matsuura into the Chiang's device double etched via can be reduced a height of the ICs so as to form several interconnection layer without increasing a volume.

### ***Conclusion***

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the

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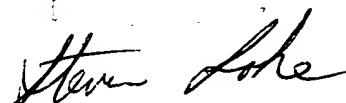
shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

dhk  
March 10, 2003

A handwritten signature in black ink, appearing to read "Steven Loh". The signature is written in a cursive, flowing style.